

**COMMONWEALTH of VIRGINIA**  
**DEPARTMENT OF ENVIRONMENTAL QUALITY**

**DRAFT SPECIAL EXCEPTION ISSUANCE FACT SHEET**

Groundwater Withdrawal Special Exception Number: GW0078700

Application Date: November 14, 2018

The Department of Environmental Quality (Department or DEQ) has reviewed the application for a Groundwater Withdrawal Special Exception. Based on the information provided in the application and subsequent revisions, DEQ has determined that the activity meets the criteria of a Special Exception defined by the regulations. The following details the application review process and summarizes relevant information for developing the Special Exception and applicable conditions.

**Special Exception Holder/ Legal Responsible Party**

Name & Address: Chickahominy Power LLC  
13800 Coppermine Road, Suite 115  
Herndon, Virginia 20171  
Phone: (703) 234-2223

**Facility Name and Location**

Name & Location: Chickahominy Power  
6721 Chambers Road, Charles City, VA 20203  
City County, Virginia  
Phone: (704) 608-5822

**Contact Information:**

Name: Jef Freeman  
E-mail: jeffreeman@balicollc.com  
Phone: (704) 608-5822

**Proposed Beneficial Use:** Chickahominy Power is an electric generating facility. Groundwater withdrawn under the terms of this Special Exception will be utilized for non-potable uses during construction and startup of the facilities and for operational uses such as evaporative cooling, boiler makeup and other non-potable process needs.

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### Processing Dates

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Processing Action	Date Occurred/Received
Pre-Application Meeting:	September 27, 2018
Application Received:	November 14, 2018
Special Exception Fee Deposited by Accounting:	November 15, 2018
Application Review Conducted:	January 25, 2019
Request for Additional Information Sent:	January 25, 2019
1 <sup>st</sup> Response to Request for Additional Information Received:	February 25, 2019
2 <sup>nd</sup> Response to Request for Additional Information Received:	May 29, 2019
Local Government Ordinance Form Received:	January 25, 2019
Application Complete:	January 25, 2019
Submit Request for Technical Evaluation:	July 10, 2019
Preliminary Technical Evaluation Received:	August 8, 2019
Draft Special Exception Package Sent:	October 17, 2019
Final Technical Evaluation Received:	October 31, 2019
Final Draft Special Exception Package Sent:	
Submit Draft Special Exception for Public Notice:	
Public Notice Published:	
End of 30-Day Public Comment Period:	
Response to Public comment:	
Public Meeting or Hearing:	

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### Application

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#### **Application Information**

##### **Description:**

##### **Background / Purpose of Facility**

Chickahominy Power, LLC is developing a 1,600-megawatt natural gas-fired combined cycle electric generating facility. The proposed facility will be located on a parcel off Chambers Road near the intersection with State Road 106. A groundwater withdrawal permit (GW0005400) was previously issued to a different owner to construct a power plant on the same site in 2002. However, that owner ultimately decided to cease development. Their production wells were abandoned in 2004 and the permit was terminated in 2005.

The facility proposes to construct two wells to supply the facility demand.

##### **Location of Facility/Withdrawal:**

Water Supply Planning Unit: Charles City County

County: Charles City

GWMA/Aquifer: Eastern Virginia Groundwater Management Area / Potomac Aquifer

Conjunctive Use Source: No conjunctive use

### **Justification for Use of a Special Exception**

DEQ is issuing a 7 year Special Exception for a groundwater withdrawal from the Potomac aquifer for Chickahominy Power Station, pursuant to § 62.1-267 of the Code of Virginia. The use of a Special Exception is justified because the proposed beneficial use is not for human consumption, the requested groundwater withdrawal is within an area that has incurred an overall decline in the Potomac Aquifer, and viable alternative water sources will be available within 7 years of Special Exception issuance. Alternatively, the issuance of a groundwater withdrawal permit, rather than a Special Exception, would allocate available groundwater supply within a multi-county area with identified groundwater resource limitations for a use other than human consumption for a permit term of up to 15 years, or longer if reissued. DEQ does not believe the issuance of a typical groundwater withdrawal permit is consistent with the Groundwater Management Act of 1992 under these circumstances.

Section 62.1-263 of the Groundwater Management Act of 1992 states that when proposed uses of groundwater are in conflict or when available supplies of groundwater are insufficient for all who desire them, preference shall be given to uses for human consumption, over all others. In evaluating permit applications, the Board shall ensure that the maximum possible safe supply of groundwater will be preserved and protected for all other beneficial uses.

The 2017-2018 Annual Simulation of Potentiometric Reported and Total Permitted Use for the Eastern Virginia Groundwater Management Area identified cells within Charles City County and surrounding counties, to include New Kent County and James City County, where water levels are simulated to fall below the critical surface in the Aquia and Piney Point Aquifers. Although in 2016 DEQ negotiated new groundwater withdrawal permits with existing permittees to establish lower groundwater withdrawal limits, the 2017-2018 Report indicates that some critical cells in this region have persisted. However, as part of these negotiations several municipal water supplies in the region have applied for and received permits to construct surface water intakes, which over the next decade will replace a portion of the current groundwater demand with surface water, as well as provide potential alternative sources for other groundwater withdrawal permittees.

A Special Exception, per § 62.1-267 of the Code of Virginia, shall not be issued for a term exceeding 15 years and shall not be renewed (9VAC25-610-220). Authorizing this groundwater withdrawal through a Special Exception provides for immediate public benefit by allowing the permittee to begin developing the capacity to provide electricity, while allowing time for existing permitted surface water supplies to become available and to design and connect necessary water supply infrastructure. Since a Special Exception cannot be renewed, a permanent withdrawal from the Potomac Aquifer is not authorized.

Subsection A of § 62.1-267 of the Groundwater Management Act of 1992 provides the Board the authority to issue a Special Exception to allow the withdrawal of groundwater in the case of unusual situations in which requiring the user to obtain a groundwater withdrawal permit would be contrary to the intended purpose of the Act. Subsection B of § 62.1-267 of the Groundwater Management Act of 1992 provides that the Board may consider additional information in review of the application, to include the amount and

duration of the proposed withdrawal and the beneficial use intended for the ground water. DEQ has set the 7 year duration for the Special Exception using the planning and construction schedule provided by the applicant detailing that 7 years was needed to complete the design, permitting and construction of a water line from New Kent to the power plant. Staff reviewed this schedule and finds it to be reasonable in its identification of milestones and timing associated with these events.

DEQ has determined that the Chickahominy Power project meets criteria for issuance of a Special Exception to utilize groundwater in lieu of a groundwater withdrawal permit for the following reasons:

- Viable water supply alternatives for cooling and steam generation will be available to Chickahominy Power LLC within the next 7 years as surrounding localities, such as New Kent County, construct surface water intakes to reduce their reliance on groundwater. Chickahominy Power LLC has negotiated a contract with New Kent County to supply water to the facility. New Kent confirms that their Board has approved the contract and supply is available for Chickahominy Power.
- If authorized by a permit, the proposed withdrawal would allocate a new withdrawal in the Potomac Aquifer, which currently exhibits declining water levels within a multi-county area, for a fifteen year permit term or longer if renewed. However, the proposed Special Exception would only authorize the withdrawal for a period of 7 years.
- Withdrawals from the Potomac Aquifer for potable water will not be required as Charles City County's existing Roxbury Industrial Park water system will supply potable water for Chickahominy Power employees. The issuance of a groundwater permit for non-human consumption uses, particularly after DEQ has recently negotiated reduced limits for groundwater withdrawal permits with existing permittees to protect and preserve groundwater, is contrary to the intended purpose of the Groundwater Management Act of 1992. Chickahominy Power will provide an important public benefit by providing cleaner electricity to consumers in the short term, while using air-cooling technology that utilizes less water than traditional evaporative cooling. The Special Exception will provide a long-term benefit to the Potomac Aquifer by limiting in duration and amount the groundwater withdrawn to only what is necessary for the development and initial operation of the power plant until it can be connected to a conjunctive water supply.

The holder of any Special Exception shall be responsible for compliance with all conditions contained in the Special Exception and shall be subject to the same requirements of groundwater withdrawal permittees, as provided in 9VAC25-610-130.

#### **Withdrawal Use, Current Need, and Projected Demand:**

##### Basis of Need:

The Chickahominy Power facility will use groundwater for non-potable purposes during construction and start-up and for supplying process and incidental facility operational water. Operational process water demands, in general terms, consists of service water to operate inlet air evaporative coolers for the gas turbine systems (significantly improving plant water efficiency on hot days) and to produce demineralized water used as boiler make up water. Incidental use includes water for maintenance and onsite fire protection if needed. Process water and incidental water uses have been combined for the facility water demand, however process water represents the majority need for demand. Separately, potable water to serve the sanitary and safety needs of approximately 45 employees will be provided by Charles City County and will not be covered by this Special Exception.



Water Demand and Projections:

The water demands provided in the application are those anticipated over the Special Exception term. No expansion beyond the initial project size or changes to the proposed water use are expected during the term of the Special Exception. The applicant provided a water balance diagram with water flow processes depicting the average and peak flow rates through the facility's various processes.

The power plant has been specifically designed to minimize the overall water demand, most notably through the use of air-cooled condenser technology in lieu of a more conventional water-cooling technology. The facility also proposes extensive use of blowdown recapture and wastewater recovery systems. Typical evaporative coolers consume approximately 50% of makeup water via evaporation, with the remaining 50% rejected as blowdown waste to maintain the evaporative cooler water chemistry. Blowdown recovery systems will be employed wherever possible to capture steam that would normally be vented to the atmosphere. For this project, "wet cooling" would have consumed approximately 11,000 gallons per minute (5.8 billion gallons per year); approximately 80% of water consumption would be due to evaporative losses, and 20% would be process wastewater to control cooling water chemistry. In "dry cooling", the circulating water system is replaced by the air-cooled condenser (ACC). An ACC condenses the water vapor from the steam turbine directly via heat exchange to the ambient air. Using "dry cooling" in lieu of "wet cooling" eliminates water lost in the condensing process, reducing water consumption by 11,000 gallons per minute (or approximately 5.8 billion gallons per year).

The project also eliminated reverse osmosis technology from the design. This eliminates the need to use groundwater to backwash membranes to remove total dissolved solids (TDS) resulting from the demineralization process. Chickahominy Power proposes to recover the blowdown waste flow from the evaporative coolers and remove excess chemical and mineral concentrations via a mixed bed ion exchange demineralization system. This water is then reused in the steam cycle, which requires highly purified demineralized water. The evaporative cooling system requires water quality that is typical of potable sources such as groundwater to prevent damage to turbine components. This state-of-the-art design reduces water consumption by 50% compared to a typical evaporative cooling system. On an annual average basis, water consumption will be reduced by an estimated 32.1 gallons per minute (16.9 million gallons per year).

The applicant proposes a yearly maximum volume of 30,000,000 gal/y for both process demand and non-potable incidental uses. The requested maximum monthly withdrawal volume is 3,500,000 gallons. The applicant projects an average monthly withdrawal volume of 2,500,000 gallons.

Withdrawal Volumes Requested:

The applicant requested the following withdrawal volumes based upon the projected groundwater demand.

Period of Withdrawal	Actual Volume (gal.)	Projected Daily Average Volume (gal/day)
Maximum Monthly:	3,500,000	112,903
Maximum Annual:	30,000,000	82,192

DEQ Evaluation

### Historic Withdrawals:

Chickahominy Power is a new facility so no historic withdrawal information is available.

### Analysis of Alternative Water Supplies:

*Surface Water Alternative:* The Chickahominy Power facility originally considered using conventional evaporative cooling technologies (wet cooling towers) and projected a use of approximately 14.4 million gallons of water per day for evaporation and blow-down. With such a significant volume, the project evaluated using surface water withdrawn from the James River at Shirley Plantation. In order to use surface water, the plant would need to include a water pretreatment process. The plant would also need to utilize reverse osmosis water treatment in the demineralization system in order to meet process requirements and to contend with fluctuations in total dissolved solids content and salinity. Wastewater would also be discharged to the James River. The applicant stated that this approach would require significant investments to address water quality and the additional complexity raised concerns regarding plant reliability. This alternative would require a pipeline from the James River intake to the plant, a distance of approximately 10 miles. Similarly, the large amount of wastewater generated by the boiler and cooling tower blowdown systems combined with the associated surface water treatment system would require discharge through a separate large diameter pipe to the James River. The applicant believes the environmental impacts associated with the construction of the required intake and discharge equipment in the river and the projected impacts to state waters from the dual pipelines would result in significant permitting challenges. Therefore, less impactful alternatives were pursued.

Chickahominy Power undertook a major redesign of its steam condensing system to reduce the overall water usage and wastewater generation. This major redesign eliminated the conventional evaporative cooling technology and adopted a dry cooling approach to minimize consumptive water losses. Initially, surface water from the James River was considered for this reduced water demand. Under this alternative, the plant would still need the same pretreatment equipment, as well as a reverse osmosis water treatment in the demineralization system to contend with fluctuations in total dissolved solids content and salinity. Also, impacts to state waters associated with the intake and pipelines would not be avoided. Therefore, this alternative was also not pursued further.

*Purchased Water Alternatives:* Charles City County was approached to determine if their Roxbury Industrial Park water system, located across Chambers Road from the Chickahominy Power project site, could satisfy the much-reduced water requirements associated with the use of air-cooled technologies. The Roxbury Industrial system utilizes wells and has permitted capacity of approximately 19,600 gallons per day, which is significantly below that required for the project. Therefore, this alternative was eliminated from further consideration.

Obtaining water from the Henrico County treatment facility was considered impractical and not pursued because it is located approximately 20 miles from the proposed site. New Kent County, located immediately adjacent to and to the north of Charles City County, was approached to determine if their current or projected water system expansions could accommodate the reduced water requirements of the Chickahominy Power project.

New Kent County has an existing groundwater withdrawal permit for a withdrawal near the project (GW0007300). The water quality is considered equivalent to the water quality that would be obtained from onsite wells, except for any additives introduced by New Kent County's water treatment program that would

need to be removed. All off-site options require the procurement of easements to allow the construction of the requisite pipeline infrastructure. Delivery of water to the project from New Kent would require the construction of a new pipeline of approximately 5 miles along a route that is being evaluated to determine the need to secure easements for crossings, such as the CSX rail line and the Chickahominy River, as well as avoidance or minimization of impacts to wetlands or historic resources.

As New Kent County is currently obtaining groundwater from the Potomac Aquifer and has sufficient capacity to supply Chickahominy Power, connecting to this system would not result in an additional long term allocation from the Potomac Aquifer beyond what is currently permitted. Additionally, on December 1, 2018, New Kent County was issued a permit from DEQ to obtain surface water (VWP 16-0763) from the Pamunkey River to reduce the County's reliance upon groundwater. Once complete, this system will further reduce demand on the aquifer as New Kent becomes a conjunctive use system. Therefore, connection to New Kent will be a significant benefit to the preservation of the Potomac Aquifer resource. As this is a viable long-term alternative for the power plant, the Special Exception requires the applicant to implement this connection within the Special Exception term.

#### Public Water Supply:

The proposed beneficial use does not contain a public water supply component. Potable water to serve the sanitary and safety needs of approximately 45 employees will come from the Roxbury Industrial Park water system owned by Charles City County.

#### Water Supply Plan Review:

Incorporating the consideration of the local water supply plan (WSP) and the State Water Resources Plan (SWRP) in the withdrawal permitting process is required per § 62.1-44.15:20 C of the State Water Control Law and 9VAC25-610, Groundwater Withdrawal Regulations. Charles City County submitted a water supply plan to DEQ in 2011. The Charles City Water Supply Plan (WSP) has a general concern with increased use of groundwater, as the county is located within the vicinity of a number of Potomac, Piney Point, and Aquia Aquifer critical cells. The county has no existing groundwater users with unused capacity that could be an alternative source of supply for this proposed facility. The 2013 WSP projected the County's population and demand to increase through the 2040 planning period. However, growth did not occur as originally anticipated and they no longer anticipate a deficit in municipal system supply by the end of the planning period. The WSP considers multiple alternatives including groundwater wells and surface water intakes, as well as possible interconnection with a neighboring locality. Interconnection seems most feasible for development areas within Charles City County that are close to a neighboring locality's water main.

#### DEQ Recommended Withdrawal Limits:

Staff reviewed the demand justification and found the calculations and methodologies sufficient to justify the requested limits. The facility documented significant efforts to reduce the requested limits to the minimum amount necessary to operate the plant. DEQ recommends the following withdrawal volumes based upon evaluation of the groundwater withdrawal application.

Period of Withdrawal	Actual Volume (gal.)	Daily Average Volume (gal/day)
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Maximum Monthly:	3,500,000	112,903
Maximum Annual:	30,000,000	82,192

### Technical Evaluation:

Aquaveo, LLC, completed a Technical Evaluation and submitted it to DEQ on October 29, 2019. Sydnor Hydro completed 48-hour and 72-hour aquifer tests to support the previous groundwater withdrawal permit at the site in 2002. Aquaveo, LLC incorporated site specific aquifer parameters based on that test data into this evaluation. The objectives of this evaluation were to determine the areas where any of the aquifers will experience at least one foot of water level decline due to the proposed withdrawal (the Area of Impact or AOI), to determine the potential for the proposed withdrawal to cause saltwater intrusion, and to determine if the proposed withdrawal meets the 80% drawdown criteria. The technical evaluation also evaluated water levels in the VAHydroGW-VCPM regional model compared to measured field values. The evaluation estimated impacts associated with the proposed withdrawal over a 7 year period, which is the term authorized for the withdrawal under this Special Exception.

Aquaveo, LLC reviewed the USGS regional observation network wells closest to the applicant's proposed wells. Aquaveo, LLC reviewed and compared simulated 2017-2018 water levels from the reported use to measured water levels closest to the applicant's withdrawal for the same year. The water level graphs for the Potomac Aquifer show a steady decline in water levels from the time of the earliest available records (1965) to approximately 2009. These observed water levels drop by more than 60 feet over the same period. Water levels from 2009 to present are observed to recover slightly. The observed water levels in the nearest monitoring wells are generally in agreement with those simulated by the regional model.

The simulation of the proposed withdrawal using the regional model did not produce a foot of drawdown in three or more cells. Using the regional model to calculate drawdown in these cases can overestimate the size of the resulting AOI and often results in drawdown that is not representative of the withdrawal spatially due to the confines of the model cells. As discussed above, Aquaveo was provided existing aquifer pump test data which allowed incorporation of site specific values for transmissivity, storage, and leakance into the evaluation. Given the inclusion of these data, the Hantush-Jacob best fit aquifer parameters obtained by Aquaveo were selected to simulate drawdown for the source aquifer because the Hantush-Jacob parameters reproduce the drawdown observed during the onsite aquifer pump tests more accurately than the Theis or Cooper-Jacob parameters. The drawdown resulting from the proposed withdrawal was therefore calculated using the Hantush and Jacob (1955) 2-dimensional analytical solution for leaky, confined aquifers.

The AOI for an aquifer is the area where the additional drawdown due to the proposed withdrawal exceeds one foot. The Hantush-Jacob analytical simulation was executed as outlined above and the results of the simulation show one foot of drawdown occurs at a maximum of approximately 540 feet from each production well.

The regional model does not indicate any changes to regional flow patterns that would increase the potential for reduced water quality.

The proposed withdrawal did not result in a simulated potentiometric surface below 80% of the distance between the top of the aquifer and the land surface. Therefore, it meets the 80% drawdown criteria. Additional information regarding this simulation can be found in the attached Technical Evaluation.



Based on the results of the Technical Evaluation, DEQ concluded that the proposed withdrawals meet the technical criteria for Special Exception issuance, which are equivalent to the criteria required for a groundwater withdrawal permit (9VAC25-610-220). A map of the AOI is included in the attached Mitigation Plan.

### Part I Operating Conditions

#### Authorized Withdrawals:

Owner Well Name	DEQ Well #	Aquifer	Type	Pump Intake Limit (ft. bls)
CP-1	118-00185	Potomac	Production	*260
CP-2	118-00186	Potomac	Production	*260

\*The wells have not been constructed at the time of Special Exception issuance. Therefore, the pump intake limit is based on an aquifer determination provided on June 7, 2002 by the DEQ Groundwater Characterization Program for DEQ Well # 118-00172, constructed for the previous permit (GW0005400). This limit is subject to change based on interpretation of data collected during construction of wells 118-00185 and 118-00186.

#### Abandoned Wells:

Owner Well Name	DEQ Well #	Aquifer
*PW-1	118-173	Potomac
*PW-1	118-174	Potomac
*PW-1	118-178	Potomac
*OW-1	118-172	Potomac
*OW-2	118-175	Potomac
*OW-3	118-176	Potomac
*OW-4	118-177	Potomac

\*Wells were constructed and then abandoned as part of a previous project at the site (GW0005400) that was cancelled.

#### Pump Intake Settings:

Since the wells have not been constructed at the time of the Special Exception issuance, the Special Exception requires a modification to include the specific depth based on the aquifer pick made after drilling the well. Upon receipt of the required geophysical log and well construction documentation, a minor modification to the Special Exception will be completed to incorporate the specific pump intake depth limits based on the site-specific aquifer top determination. The Special Exception requires that the pumps be placed no lower than the top of the uppermost confined aquifer that a well utilizes as a groundwater source in accordance with 9VAC25-610-140 A 6.

#### Withdrawal Reporting:

Groundwater withdrawals are to be recorded monthly and reported quarterly on reporting forms provided by DEQ.

### **Water Conservation and Management Plan:**

A Water Conservation and Management Plan (WCMP), subject to the requirements of 9VAC25-610-100 B, was submitted and reviewed as part of the application process. The accepted Plan is to be followed by the Special Exception Holder as an operational Plan for the facility/water system. In addition, the Special Exception includes conditions requiring a leak detection and repair program that includes the following:

- Documentation that the leak detection and repair program defined in the WCMP has been initiated is due one year after the initiation of withdrawals.
- A result of an audit of the total amount of groundwater used in the distribution system and operational processes is due by the end of the second year after the start of withdrawals.
- A report on the plan's effectiveness in reducing water use, including revisions to those elements of the WCMP that can be improved and addition of other elements found to be effective based on operations to date shall be submitted after four years from the start of groundwater withdrawals.

### **Mitigation Plan:**

The predicted AOI resulting from the Technical Evaluation extends beyond the property boundaries in the Potomac Aquifer. Given this prediction, a Mitigation Plan to address potential claims from existing well owners within the predicted area of impact is included in the Special Exception by reference. Since the Mitigation Plan is incorporated into the Special Exception, the Plan shall remain in effect until the expiration or termination of the Special Exception, whichever comes first.

### **Well Tags:**

Well tags will be provided by DEQ when the wells are constructed.

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## **Part II Special Conditions**

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### **Geophysical Log Data Collection:**

Geophysical log information is needed to evaluate the top of the aquifer in use and the permitted pump intake limit. While the previous permit at this site identified the top of the Potomac Aquifer, the top of the aquifer typically varies by well location over the same site. The Department requires collection of a geophysical log for each new well to be included in a Groundwater Withdrawal Special Exception. The Special Exception holder must contact DEQ at least two months prior to scheduling the geophysical logs to allow for Department scheduling.

The collection of geophysical log data requires a borehole to be drilled at least to the depth of the deepest facility well, or an alternative depth at the discretion of the Department, and the logging equipment run down the full depth of the hole. Geophysical logging is to include Spontaneous Potential, Single Point

Resistance, 16/64 Short and Long Normal, Natural Gamma at a scale of 20 feet per inch. Department staff must be present for the geophysical logging to evaluate the log and well cuttings.

### **Pump Intake Determination and Setting:**

The Special Exception Holder shall set the pump intake for Wells CP-1 (DEQ # 118-00185) and CP-2 (DEQ# 118-00186) to no lower than the top of the Potomac Aquifer as determined by Department staff based on new geophysical log data obtained by the Special Exception holder in accordance with Part III K.3 of this Special Exception. The Special Exception holder is to notify the Department of the work schedule and to submit written documentation of the pump setting within 30 days of the work.

### **Well Abandonment:**

9VAC25-610-220 states that Special Exceptions shall not be renewed, except for those related to groundwater remediation activities. Since this exemption cannot be renewed, at the end of the term the Special Exception requires Wells CP-1 (DEQ # 118-00185) and CP-2 (DEQ# 118-00186) to be abandoned in accordance with Department of Health guidelines. Documentation must be submitted to the DEQ within 30 days of abandonment.

### **Alternative Source Development Report:**

By April 1 of each year, Chickahominy Power shall submit to the Department an annual progress report summarizing all completed, ongoing, and future efforts to connect to the New Kent County conjunctive use water supply prior to the expiration of the Special Exception.

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### **Part III General Conditions**

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General Conditions are applied to all Groundwater Withdrawal Special Exceptions, as stated in the Groundwater Withdrawal Regulations, 9VAC25-610.

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### **Public Comment**

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*The following sections will be completed after close of the public comment period.*

### **Relevant Regulatory Agency Comments:**

#### Summary of VDH Comments and Actions:

This facility is not a public water supply so soliciting comments from VDH was not required.

### **Public Involvement during Application Process:**



Local and Area wide Planning Requirements: The Charles City County Administrator on November 9, 2018 that the facility's operations are consistent with all ordinances.

Public Comment/Meetings:

The public notice was published in xxxxxx on XXX. The public comment period ran from xxxxx to xxxxx

**Changes in Special Exception Part II Due to Public Comments**

Changes, if necessary, to be determined after public comment period.

**Changes in Special Exception Part III Due to Public Comments**

Changes, if necessary, to be determined after public comment period.

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**Staff Findings and Recommendations**

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Based on review of the Special Exception application, staff provides the following findings.

- The proposed activity is consistent with the provisions of the Ground Water Management Act of 1992, and will protect other beneficial uses.
- The proposed Special Exception addresses minimization of the amount of groundwater needed to provide the intended beneficial use.
- The effect of the impact will not cause or contribute to significant impairment of state waters.
- This proposed Special Exception includes a plan to mitigate adverse impacts on existing groundwater users.

DEQ has made a tentative decision to issue Groundwater Withdrawal Special Exception Number GW00078700, pending review of public comments received.

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**Attachments**

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1. Technical Evaluation
2. Water Conservation Plan
3. Mitigation Plan
4. Public Comment Sheet (pending)

Approved: \_\_\_\_\_  
Director, Office of Water Supply

Date: \_\_\_\_\_

**COMMONWEALTH of VIRGINIA  
DEPARTMENT OF ENVIRONMENTAL QUALITY**

**TECHNICAL EVALUATION FOR PROPOSED GROUNDWATER WITHDRAWAL**

**Date:** October 29, 2019

**Application /Permit Number:** Chickahominy Power Plant GW0078700

**Owner / Applicant Name:** Chickahominy Power LLC

**Facility / System Name:** Chickahominy Power Plant

**Facility Type:** Natural Gas combined cycle electric generating facility

**Facility / System Location:** Charles City County, Virginia

The Commonwealth of Virginia's Groundwater Withdrawal Regulations (9VAC25-610-110(D) state that, for a permit to be issued for a new withdrawal, to expand an existing withdrawal, or reapply for a current withdrawal, a technical evaluation shall be conducted. This report documents the results of the technical evaluation conducted to meet the requirements for the issuance of a permit to withdrawal groundwater within a Groundwater Management Area as defined in (9VAC25-600-10 et seq.).

This evaluation determines the:

- (1) The Area of Impact (AOI): The AOI for an aquifer is the areal extent of each aquifer where one foot or more of drawdown is predicted to occur as a result of the proposed withdrawal.
- (2) Water Quality: The potential for the proposed withdrawal to cause salt water intrusion into any portions of any aquifers or the movement of waters of lower quality to areas where such movement would result in adverse impacts on existing groundwater users or the groundwater resource as per (9VAC25-610-110(D)(2), and
- (3) The Eighty Percent Drawdown (80% Drawdown): The proposed withdrawal in combination with all existing lawful withdrawals will not lower water levels, in any confined aquifer that the withdrawal impacts, below a point that represents 80% of the distance between the land surface and the top of the aquifer at the points where the one-foot drawdown contour is predicted for the proposed withdrawal as per 9VAC25-610-110(D)(3)(h).

**Proposed Withdrawal Limits:**

<b>Proposed Withdrawal Limits</b>	
<b>Annual Value</b>	30,000,000 gallons ( 82,191 average gpd)
<b>Monthly Value</b>	3,500,000 gallons ( 112,903 average gpd)

**Requested Apportionment of Withdrawal:**

DEQ Well #	Owner Well #	Aquifer	Percent of Withdrawal
118-00185	CP-1	Potomac	50%
118-00186	CP-2	Potomac	50%

**Summary of Proposed Withdrawal:**

Chickahominy Power, LLC is developing a 1,600 megawatt natural gas-fired combined cycle electric generating facility. There are two (2) wells proposed for the facility, with each to have an anticipated capacity to deliver up to 175 gpm. The annual average total withdrawal rate is 57.1 gpm with the maximum month being 79.9 gpm. The two proposed wells will alternate in operation (only one well in use) to supply water.

A groundwater withdrawal permit (GW0005400) was issued at this site in 2002 for another natural gas power plant with the same name of Chickahominy Power. The permit was issued on October 1, 2002 and was revoked at the request of the permittee. The power plant was never built and the wells were abandoned. Since the facility is on the same property the aquifer pick and aquifer test information are provided for this permit application and Technical Evaluation.

**Production Well(s):** The wells have not been constructed and are based on the proposed Well construction information below:

DEQ Well #	Owner Well #	Depth	Pump Capacity (gpm)	Screen Interval (ft)	Pump Set (ft)	Coordinates
118-00185	CP-1	*450	TBD	*303-323, 325-358, 373-403, 410-430	*250	*37° 26' 14.656"N 77° 9' 2.568"W
118-00186	CP-2	*450	TBD	*303-323, 325-358, 373-403, 410-430	*250	*37° 26' 3.3"N 77° 9' 18.521"W

\* All information is proposed since the wells have not been constructed. The information is based on aquifer pick generated from the previous wells installed at the site in 2002 that have since been abandoned.

**Geologic Setting:**

The proposed Chickahominy Power Plant production wells (applicant wells) are located in western Charles City County. The applicant wells are screened in the Potomac aquifer. USGS Professional Paper 1731, The Virginia Coastal Plain Hydrogeologic Framework (VCPHF), is the most recent study discussing the aquifers and confining units of the Virginia Coastal Plain. The study utilized numerous boreholes throughout the Virginia Coastal Plain to interpolate the elevations of the various hydrogeologic units found in the Coastal Plain. According to the study, the Potomac aquifer is the "largest, deepest, and most heavily used source of groundwater in the Virginia Coastal Plain." The aquifer is underlain across its entire extent with basement bedrock. The aquifer is found below the Potomac confining zone. The aquifer is primarily composed "of fluvial-deltaic coarse-grained quartz and feldspar sands and gravels and interbedded clays." The nearest geologic cross section, ED-ED', from the USGS Professional Paper 1731 is shown in the figure at the end of this report.



**Hydrologic Framework:**

Data from the VCPHF is reported in this technical report to illustrate the hydrogeologic characteristics of the aquifers in the Virginia Coastal Plain near the applicant wells and identify major discrepancies between regional hydrogeology and site logs interpreted by the DEQ staff geologist. The Virginia Coastal Plain Model<sup>1</sup> (VCPM) framework was constructed by extracting the hydrogeologic unit tops and thicknesses from the VCPHF. The original USGS VCPM was updated and adapted for use in the VA-DEQ well permitting process and is referred to as VAHydroGW-VCPM.

**VAHydroGW-VCPM Model:**

The following table lists the planned locations of the applicant production wells within the VAHydroGW-VCPM Model.

<b>VAHydroGW-VCPM Model Grid</b>				
<b>Well</b>	<b>Well Number</b>	<b>MPID</b>	<b>Row</b>	<b>Column</b>
CP-1	118-00185	-	67	21
CP-2	118-00186	-	68	21

The following average aquifer top elevations and thicknesses are simulated in the VAHydroGW-VCPM at the model cells containing the applicant well.

<b>VAHydroGW-VCPM Model Hydrogeologic Unit Information – Row 67 &amp; 68/Column 21</b>		
<b>Aquifer</b>	<b>Elevation (ft-msl)</b>	<b>Depth (ft-bls)</b>
Surface	125	-8
Surficial Aquifer (bottom)	76	42
Piney Point (top)	22	95
Piney Point (bottom)	-13	130
Aquia (top)	-79	196
Aquia (bottom)	-121	238
Potomac (top)	-138	255
Potomac (bottom)	-615	732

Note: ft-msl = feet mean sea level

**Groundwater Characterization Program Recommendations:**

DEQ staff geologist reviewed available information and made the following determinations regarding the location of the aquifer tops for the previous permit issued on the site. The top of the Middle Potomac aquifer was identified in an aquifer pick provided on June 7, 2002 by Scott Bruce for Well OW-1 constructed for the previous permit (GW0005400). The aquifer pick did not identify an overlying Upper Potomac aquifer at the location so the Middle Potomac top is considered as the top of the Potomac Aquifer under the Virginia Coastal Plain Hydrogeologic Framework (USGS Professional Paper 1731).

<b>Unit</b>	<b>Well #1 (ft-bls)</b>
Top of Potomac	260
Bottom of Potomac	-

<sup>1</sup> Heywood, C.E., and Pope, J.P., 2009, Simulation of groundwater flow in the Coastal Plain aquifer system of Virginia: U.S. Geological Survey Scientific Investigations Report 2009–5039, 115 p.

## Comparison of the Hydrogeologic Framework and Groundwater Characterization Program

### Recommendations:

The VCPMF identifies the average top of the Potomac aquifer at depths of -138 ft-msl (255 ft-bls) at the cells containing the proposed applicant production wells. The Potomac aquifer top estimation, by the DEQ staff geologist, of 260 ft-bls is in general agreement with the VCPMF.

### Water Level Comparison:

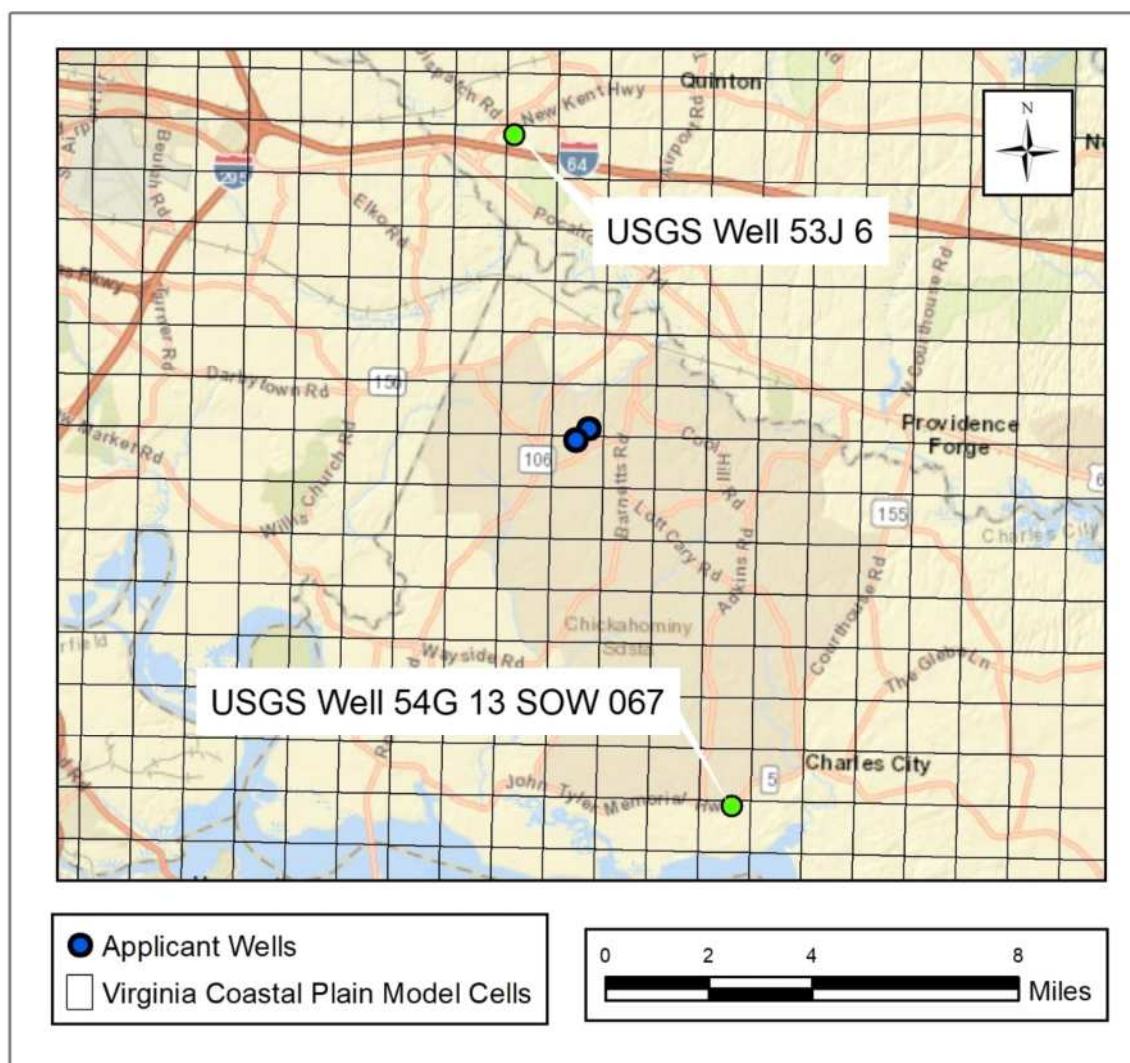
The 2017-2018 *Annual Simulation of Potentiometric Groundwater Surface Elevations of Reported and Total Permitted Use* report and modeling files<sup>2</sup> provide two sets of simulated potentiometric water surface elevations. These water elevations are based upon, 1) the reported withdrawal amount of wells in the VAHydroGW-VCPM model ("the reported use simulation") and, 2) the total permitted withdrawal amount for wells in the VAHydroGW-VCPM model ("the total permitted simulation"). USGS regional observation network well water levels were compared to the water levels in the 2018 report in order to evaluate the performance of the regional model in the vicinity of the applicant wells and assess historical groundwater trends. In the tables below, simulated 2017 water levels from the reported use simulation were compared to USGS measured water levels for the same year. For comparison, the total permitted simulated water levels are also reported. The total permitted water levels are taken from the end of the 50 year total permitted simulation and represent simulated water levels, 50 years from present, if all GWMA wells were to pump at their total permitted amount.

The USGS regional observation network wells closest to the applicant well are shown in Figure 1 and listed in the following table. The depths of these wells correspond with the Potomac aquifer. The distances from the applicant well to the USGS wells are also given in the table. The VAHydroGW-VCPM row and column containing the USGS wells are also given. The water levels obtained from the regional observation networks wells are shown in Figure 2 and Figure 3. These figures also show the water levels from the reported use VAHydroGW-VCPM simulation for the cell containing each USGS well. The 2017 annual average water levels observed in the regional observation network wells are given in the following table.

The water level graphs for the Potomac aquifer show a steady decline in water levels from the time of the earliest available records (1965) to approximately 2009. Observed water levels in in well 53J 6 drop by more than 70 feet over the same time period. Water levels from 2009 to present are observed to recover slightly. The observed water levels in the nearest USGS wells are generally in agreement with those simulated by the VAHydroGW-VCPM – with simulated water levels becoming approximately 10 feet higher than observed water levels over the last decade.

<sup>2</sup> Refer to "2017-2018 Annual Simulation of Potentiometric Groundwater Surface Elevations of Reported and Total Permitted Use" at <https://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterCharacterization/ReportsPublications.aspx>

Potomac Aquifer		
Measurement	Well 53J 6	Well 54G 13 SOW 067
Distance from nearest applicant well (miles)	5.9	7.7
Elevation (ft-msl)	115.0	35.0
VAHydroGW-VCPM Row	62	75
VAHydroGW-VCPM Column	20	24
VAHydroGW-VCPM Cell Elevation	117	59
USGS Regional Well 2017 Average Water Level (ft-bls)	163.2	75.6
USGS Regional Well 2017 Average Water Level (ft-msl)	-48.2	-40.6
VAHydroGW-VCPM 2017 Reported Use Simulated Water Level (ft-bls)	152.0	88.9
VAHydroGW-VCPM 2017 Reported Use Simulated Water Level (ft-msl)	-35.0	-29.9
VAHydroGW-VCPM Total Permitted Simulated Water Level (ft-bls)	166.9	100.5
VAHydroGW-VCPM Total Permitted Simulated Water Level (ft-msl)	-49.9	-41.5



**Figure 1. Nearest USGS regional observation network wells.**



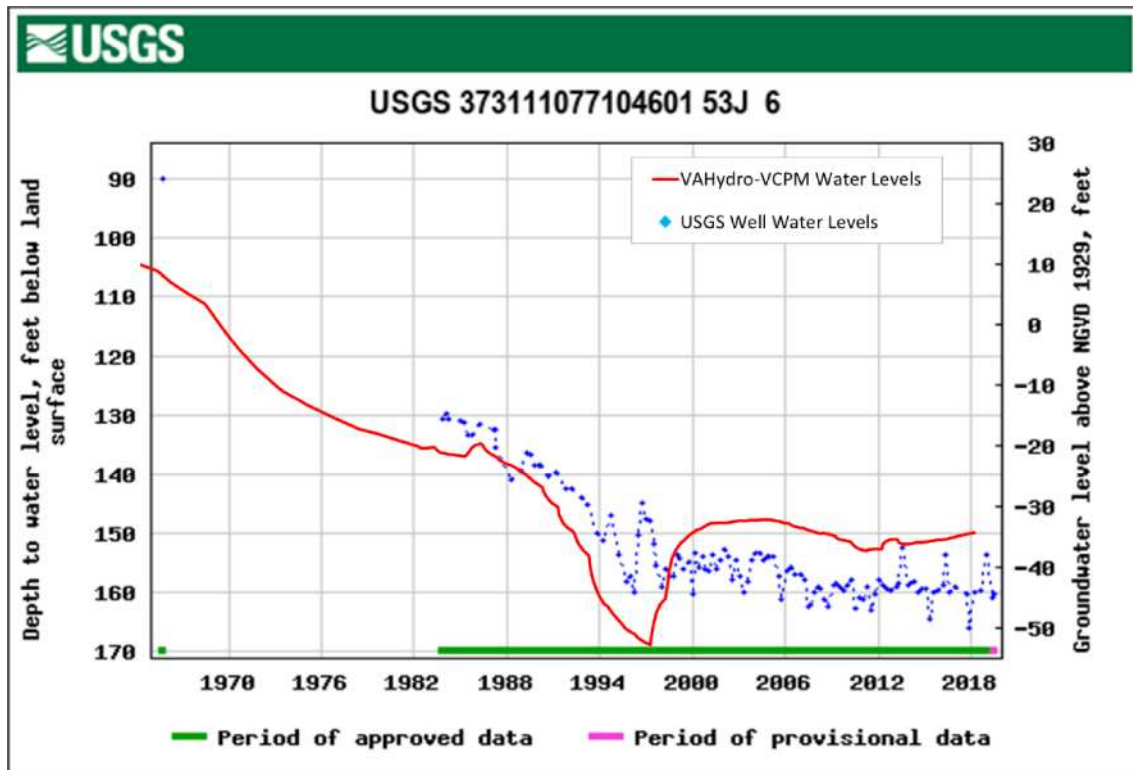


Figure 2. USGS Regional Observation Well 53J 6, Potomac aquifer water levels (Patapsco Formation) recorded from 1965 to present (well depth 305 ft bls, land surface 115.0 ft msl) and VAHydroGW-VCPM reported use water levels.

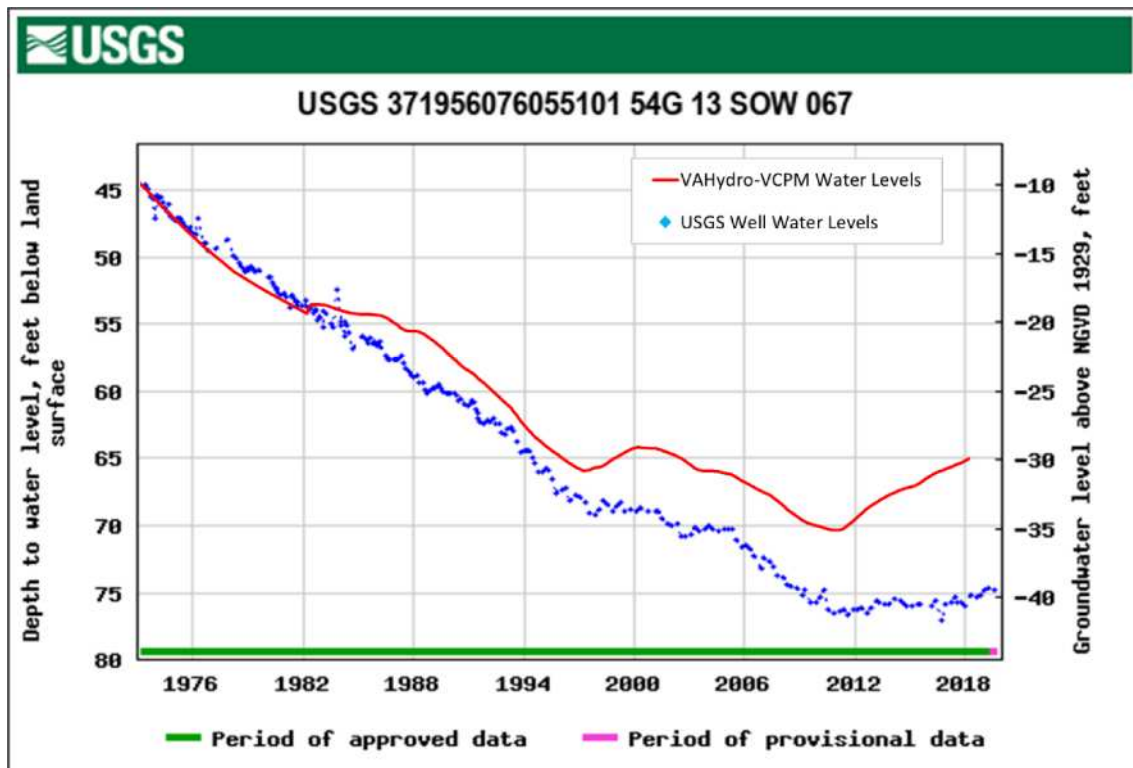


Figure 3. USGS Regional Observation Well 54G 13 SOW 067 Potomac aquifer (Patapsco Formation) water level recorded intermittently from 1973 to present (well depth 227 ft bls, land surface 35.0 ft msl) and VAHydroGW-VCPM reported use water levels.

**Aquifer Test:***Overview*

Sydnor Hydro, Inc.<sup>3</sup> completed two aquifer tests at this site in early 2002 at approximately 300 gpm. The aquifer testing program incorporated one pumping well (PW-2, 118-00174) and four observation wells (OW-1, 118-00172; OW-2, 118-00175; OW-3, 118-00176; and OW-4, 118-00177). In January 2002, drawdown during 48-hours of pumping, at a rate of approximately 300 gallons per minute (gpm), was monitored in the production well and the observation wells. However, near the end of the test a power supply failure occurred resulting in a reduced pumping rate. Consequently, a second pump test involving the same wells was completed in February 2002. For the second aquifer pump test, drawdown during 72-hours of constant pumping, at a rate of approximately 300 gallons per minute, was monitored in the production and four observation wells. Recovery was also measured in the same wells for approximately 42 hours after pumping had ceased. The following table lists the wells involved in the aquifer pump tests.

Well Name	DEQ Well Number	Distance/Direction from Pumping Well	Aquifer(s) monitored
PW-2 (Production Well)	118-00174	0 (Pumping Well)	Potomac
OW-1 (Observation Well)	118-00172	100 feet	Potomac
OW-2 (Observation Well)	118-00175	~100 feet	Piney Point
OW-3 (Observation Well)	118-00176	~50 feet	Aquia
OW-4 (Observation Well)	118-00177	50 feet	Potomac

*Consultant Analysis*

The data and results of the testing were provided in a formal report to the DEQ. As is typical, no drawdown was observed in OW-2 or OW-3 because they are not screened in the source aquifer (Potomac). The test results from PW-2, OW-1, and OW-4 from both aquifer test were analyzed by Sydnor Hydro using the Cooper and Jacob method (straight-line method). The average value of aquifer transmissivity was 4,529 ft<sup>2</sup>/day and the average storage coefficient was 0.000349.

*DEQ Analysis*

Aquaveo<sup>4</sup> analyzed the data from the applicant aquifer test on behalf of the Virginia DEQ using the AquiferWin32 software. Due to the power fluctuation during the January aquifer pump test, only the February pump test results were analyzed. The drawdown data from OW-1 and OW-4 were evaluated using the Theis (1935) and Hantush-Jacob (1955) analytical solutions. As is typical of the Potomac aquifer, the best statistical fit was to the solution developed by Hantush and Jacob for constant discharge from a fully penetrating well in a leaky, confined aquifer (see Figures 4 through 7). The best fit aquifer parameters as determined by Aquaveo staff are outlined in the following table and illustrated in Figures 5 and 7.

DEQ Aquifer Coefficient Analyses				
Observation Data Well	Method	Transmissivity (ft <sup>2</sup> /day)	Storage Coefficient	1/B (ft <sup>-1</sup> )
OW-1	Hantush-Jacob - Drawdown	4,409.85	4.59 x 10 <sup>-4</sup>	1.10 x 10 <sup>-4</sup>
OW-4	Hantush-Jacob - Drawdown	4,416.82	4.32 x 10 <sup>-4</sup>	1.17 x 10 <sup>-4</sup>
<b>Average:</b>		<b>4,413.34</b>	<b>4.45 x 10<sup>-4</sup></b>	<b>1.14 x 10<sup>-4</sup></b>

<sup>3</sup> Sydnor Hydro, Inc., 2111 Magnolia St, Richmond, VA 23223, Phone: (804) 643-2725

<sup>4</sup> Aquaveo, LLC., 3210 North Canyon Road, Suite 300, Provo, Utah 84604, Phone: 801-691-5528

## Theis

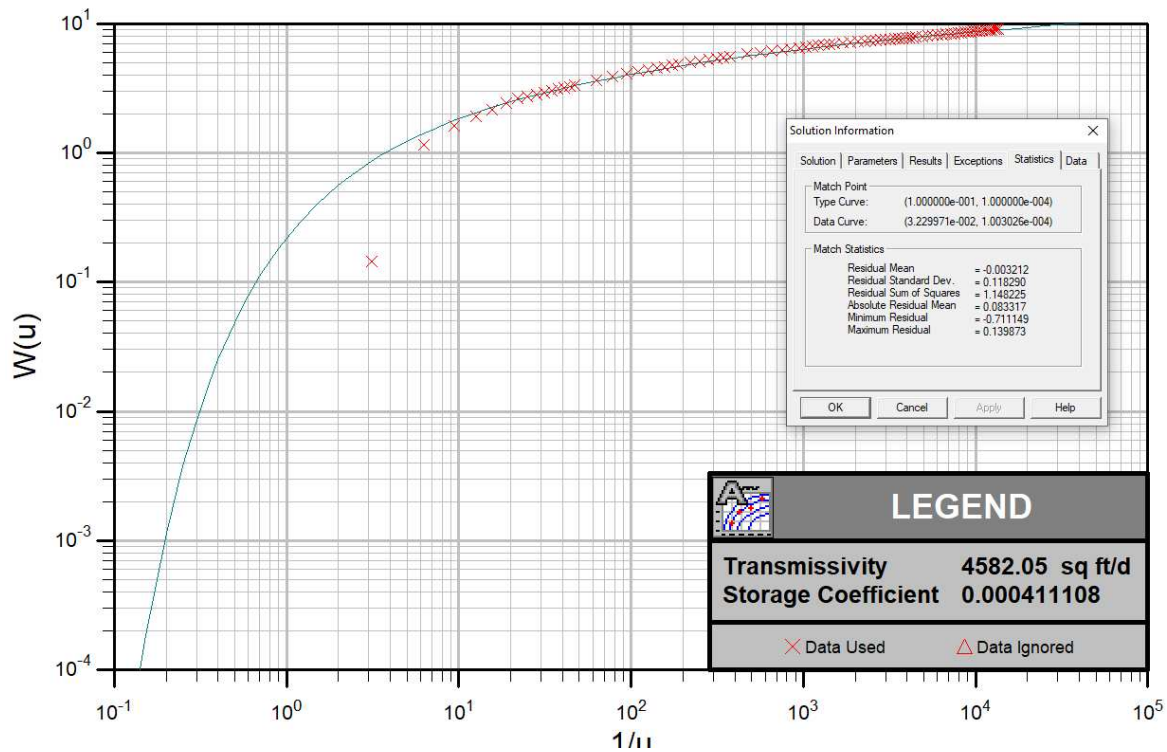


Figure 4. OW-1 Potomac aquifer drawdown observations with Theis analytical curve.

## Hantush

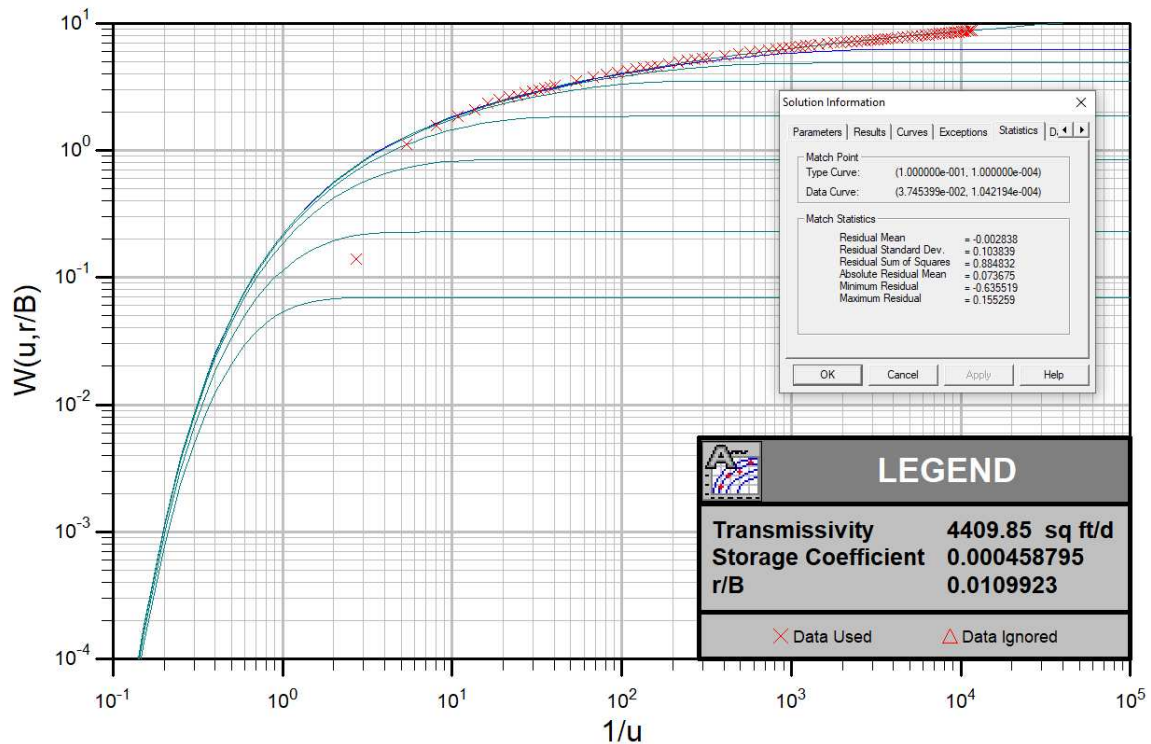
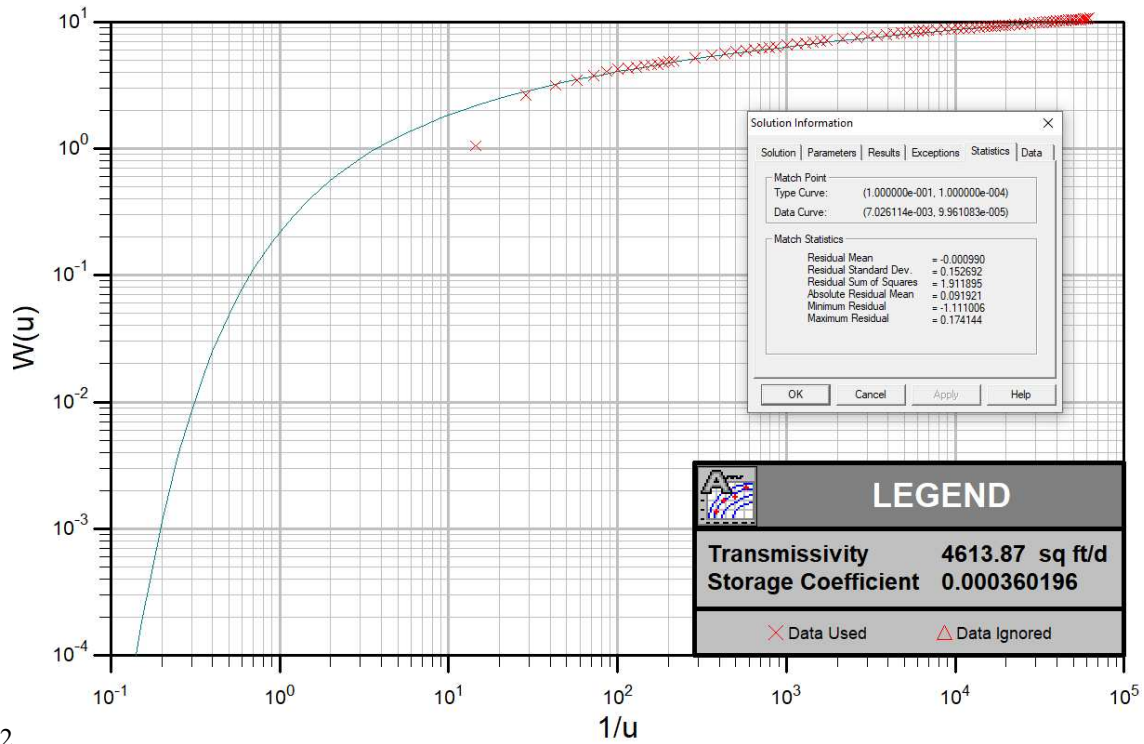


Figure 5. OW-1 Potomac aquifer observations with Hantush and Jacob analytical curves.

## Theis



2

Figure 6. OW-4 Potomac aquifer drawdown observations with Theis analytical curve.

## Hantush

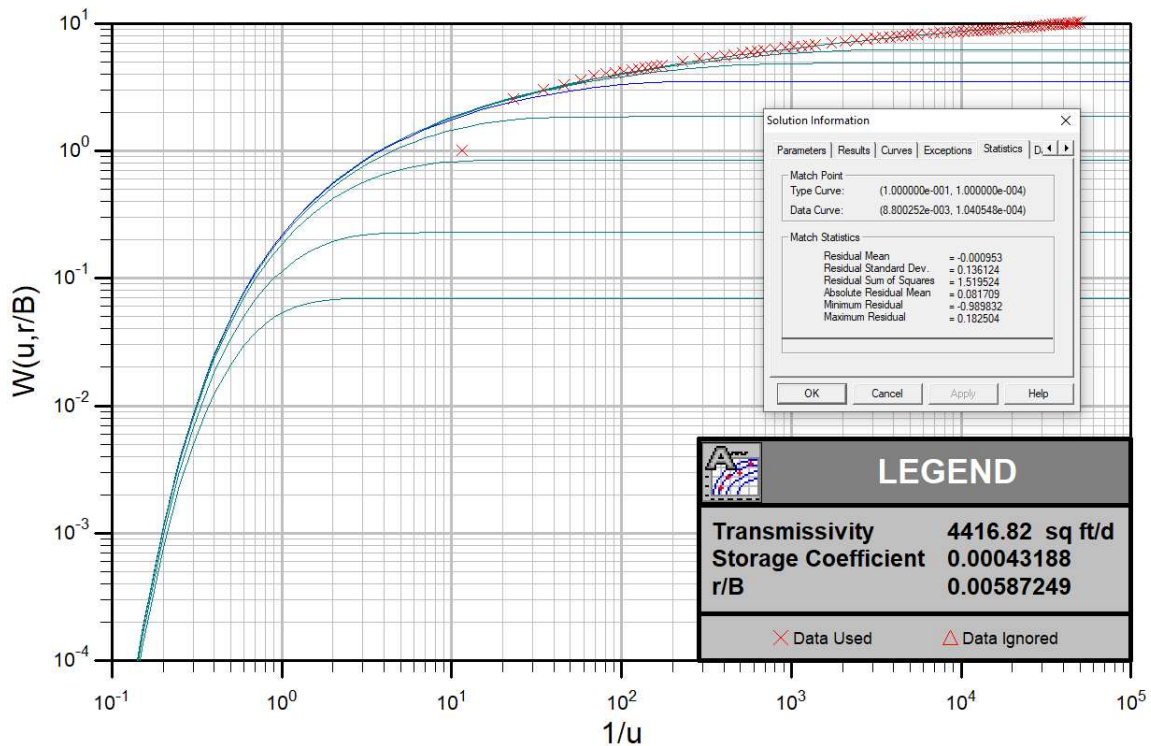


Figure 7. OW-4 Potomac aquifer observations with Hantush and Jacob analytical curves.

The average hydraulic properties for the VAHydroGW-VCPM cells containing the applicant wells are shown in the following table.

Hydrogeologic Unit	Horizontal Conductivity (ft/day)	Transmissivity (ft <sup>2</sup> /day)	Storage Coefficient	Specific Storage (1/ft)
Surficial (Columbia) aquifer	2	88	-	0.000032
Piney Point aquifer	20	700	0.00113	0.000032
Aquia aquifer	109	4,578	0.00135	0.000032
Potomac aquifer	9.9	4,708	0.000632	0.00000132

The pump test Potomac transmissivity and storage coefficient values obtained by Sydnor Hydro and Aquaveo are in general agreement with the values used in the VAHydroGW-VCPM. Local variations in aquifer hydrogeologic properties are expected when compared to a regional model such as the VAHydroGW-VCPM. Large discrepancies are noted by the VA DEQ and incorporated into VAHydroGW-VCPM model maintenance and updates.

### Model Results

#### Evaluation of Withdrawal Impacts:

The magnitude of the proposed withdrawal does not allow for assessment of the AOI using the VAHydroGW-VCPM. The maximum simulated drawdown was less than one foot at the nearest model node; consequently, an AOI could not be created using the VAHydroGW-VCPM. Instead, the AOI resulting from the proposed withdrawal was calculated using the Hantush and Jacob (1955) 2-dimensional analytical solution for leaky, confined aquifers. The Hantush-Jacob method was selected because it was the best statistical fit to the drawdown observed during the onsite aquifer pump test.

Aquifer transmissivity, storage, and leakance were obtained from the onsite aquifer testing outlined in the previous section of this report. The Hantush-Jacob best fit aquifer parameters obtained by Aquaveo were selected to simulate drawdown for the source aquifer because the Hantush-Jacob parameters reproduce the drawdown observed during the onsite aquifer pump tests more accurately than the Theis or Cooper-Jacob parameters. Drawdown was calculated using the following parameters:

#### Model Input Parameters (source: analysis of onsite aquifer pump test by Aquaveo):

Transmissivity	=	4,413 ft <sup>2</sup> /day
Storage Coefficient	=	$4.45 \times 10^{-4}$
1/B	=	$1.14 \times 10^{-4}$ (ft <sup>-1</sup> )

Withdrawal rate/Simulation Time = 7 years at 30,000,000 gallons/year (82,191 gpd). The simulation was executed for 7 years because at that time the produce wells are scheduled to be taken offline and water supplied from New Kent's Public Water System. As such, impacts from the production wells are not expected to extend past the 7-year mark.

#### Area of Impact:

The AOI for an aquifer is the area where the additional drawdown due to the proposed withdrawal exceeds one foot. The Hantush-Jacob analytical simulation was executed as outlined above and the results of the



simulation show one foot of drawdown occurs at a maximum of approximately 540 feet from each production well.

**Water Quality:**

The regional model (VAHydroGW-VCPM) does not indicate any changes to regional flow patterns that would lead to reduced water quality.

**80 % Drawdown:**

The 80% drawdown criterion was evaluated using the VAHydroGW-VCPM and the Hantush-Jacob analytical simulation. A base simulation was developed to predict the impacts from all existing permits (except the applicant well) operating at their maximum withdrawal limit along with the 2012 use reported in non-regulated portions of Virginia's Coastal Plain. The base simulation used the 2018 Total Permitted pumping rates and 2017 simulated Reported Use water levels as starting conditions. The base simulation was executed for 7 years. A second simulation was conducted using the 2D Hantush-Jacob analytical simulation to simulate drawdown resulting from the applicant wells using the parameters and withdrawal rate listed above in the *Model Input Parameters* section of this report. For the baseline simulation, the Potomac aquifer for the VAHydroGW-VCPM cells containing the applicant wells (row 67 & 68/column 21) was simulated to have a potentiometric surface of -46.4 ft-msl. The analytical simulation simulated a maximum drawdown of 2.3 feet (assuming a 6-inch screen diameter).

Subtracting the maximum drawdown simulated in the analytical simulation from the simulated water level in the baseline VAHydroGW-VCPM simulation at the cell node results in a simulated water level of -48.7 ft-msl for the Potomac aquifer. This approach for simulating the potentiometric surface elevation is the most conservative for the resource. The average elevation of the Potomac aquifer top at the VAHydroGW-VCPM cells containing the applicant wells is -138 ft-msl. The 80% drawdown requirement allows the potentiometric surface (based on the critical surface elevation calculated from the VAHydroGW-VCPM data) to be reduced to -85.1 ft-msl. Therefore, the water level in the source aquifer is not simulated to fall below the critical surface.

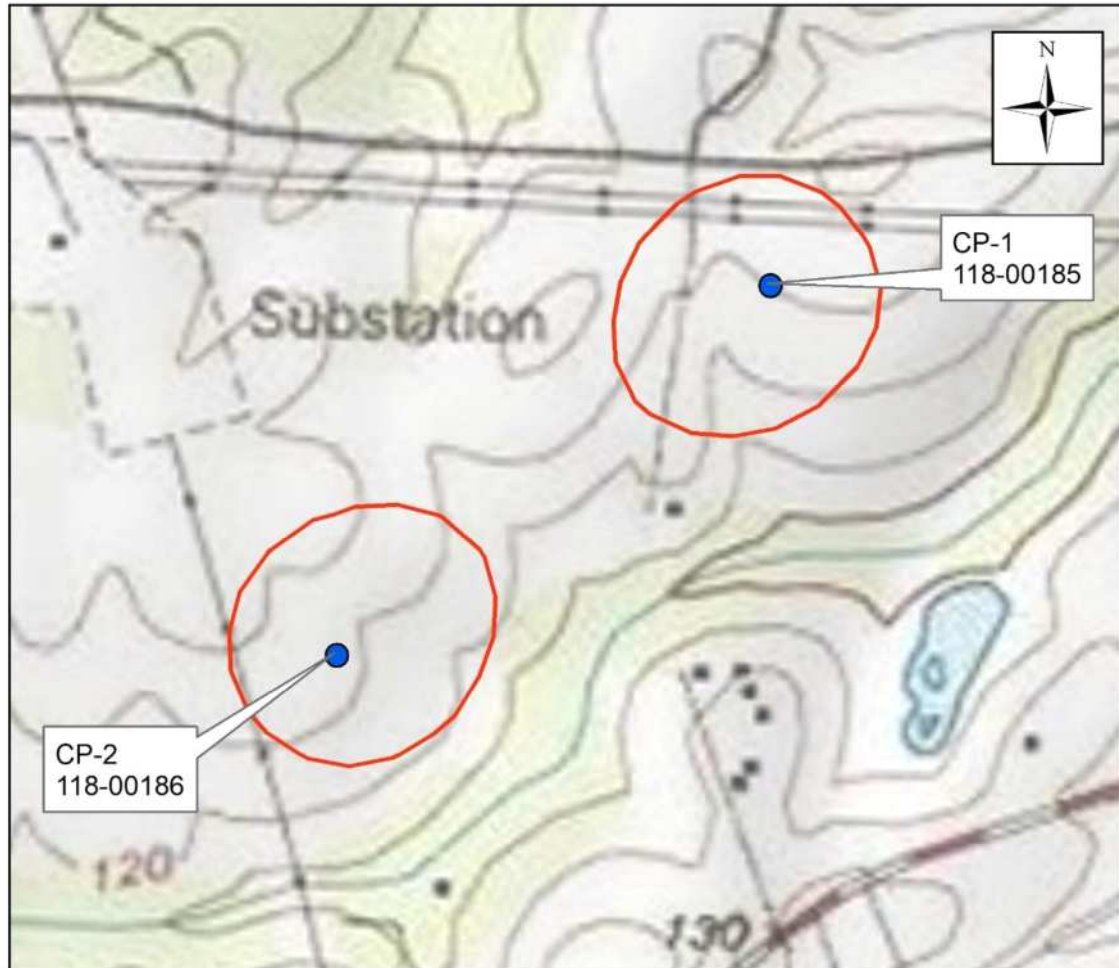
Additionally, the Potomac aquifer AOI does not contain or intersect any VAHydroGW-VCPM cells simulated to have a potentiometric water level below the 80% drawdown requirement. Therefore, this withdrawal is within the limits set by the 80% drawdown criterion.

The requested withdrawal is allocated 100% to the Potomac aquifer. The technical evaluation analysis indicated that the apportionment of the requested withdrawal amount among the applicant production wells had no significant effect on the outcome of the technical evaluation.

**Conclusion:**

The withdrawal requested by Chickahominy Power LLC for the Chickahominy Power Plant satisfies the technical evaluation criteria for permit issuance. The AOI for the Potomac aquifer is identified on the following map. There are no existing permitted wells within the simulated AOI.

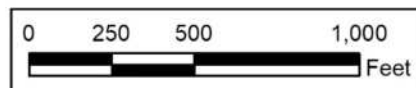
## Chickahominy Power Plant Area of Impact - Potomac Aquifer



● Chickahominy Power Plant Wells

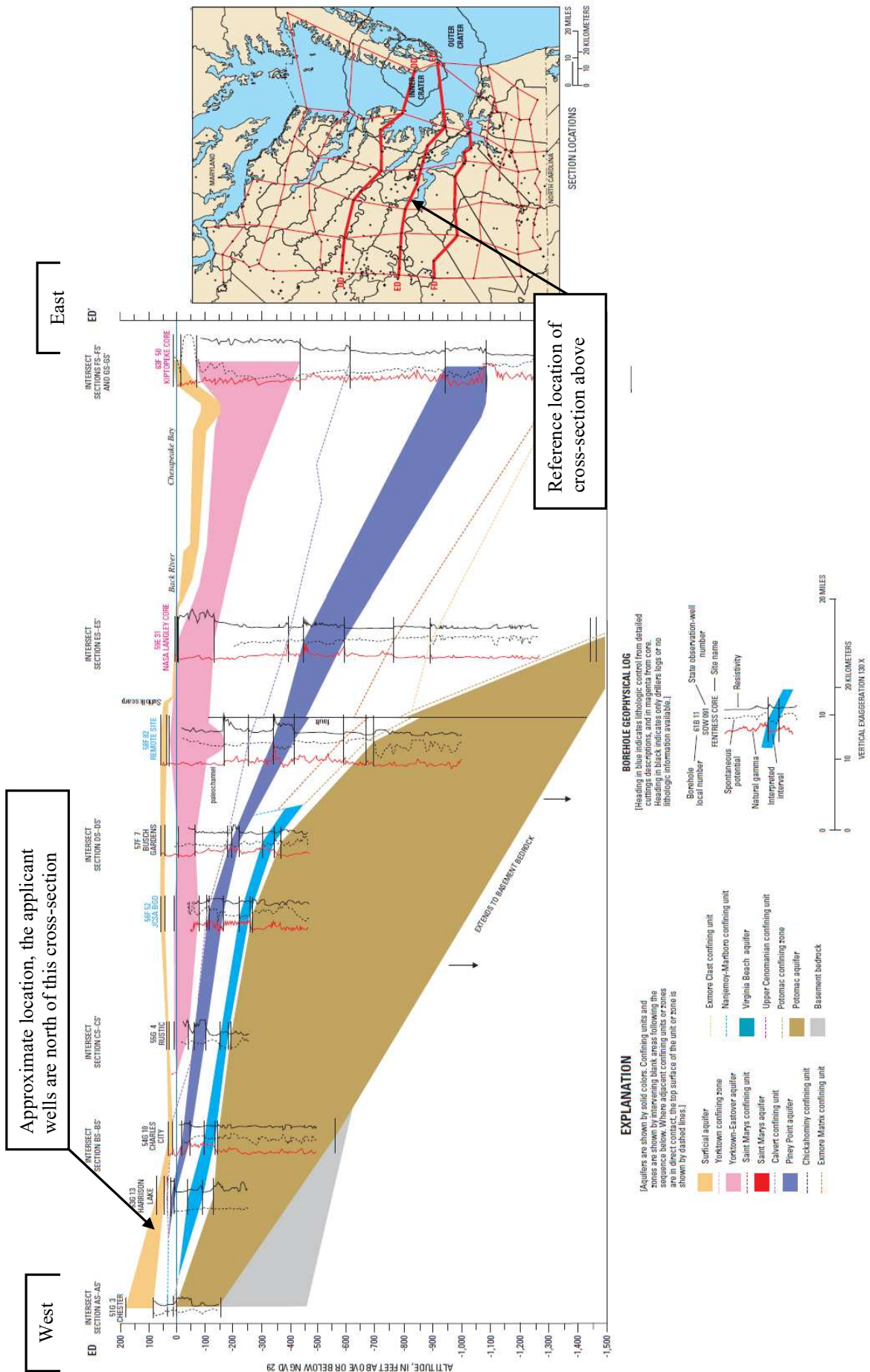
○ Area of Impact

Simulated drawdown at or exceeding one foot in the Potomac aquifer resulting from a 2-dimensional Hantush and Jacob (1955) simulation of 82,191 average gallons per day for 7 years from the Potomac aquifer. The maximum radius of one-foot drawdown (Area of Impact) occurs approximately 540 feet from each production well.



Technical Evaluation performed  
by Aquaveo, LLC for the Virginia  
DEQ, Office of Water Supply  
October 29, 2019





Coastal Plain (2006) Cross Section ED-ED' from USGS Professional Paper 1731.

**Chickahominy Power, LLC  
Charles City County, Virginia**

**Water Conservation and Management Plan**

**Revised May 9, 2019**

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## **1.0 INTRODUCTION**

### **1.1 Background**

Chickahominy Power, LLC is developing a nominal 1,600 megawatt natural gas-fired combined cycle electric generating facility in Charles City County, Virginia. The facility will produce enough electricity to supply approximately one million residential customers. The proposed facility is expected to be one of the most efficient and environmentally clean power generating facilities in the region and is anticipated to displace older, less efficient and less environmentally clean facilities and replace a number of coal fired generating facilities that are scheduled to be taken out of service.

The Chickahominy Power facility will be unique to the Southeastern area of Virginia given that it will be one of a very few, latest generation of natural gas-fired combined cycle electric generating facilities in operation. In view of the critical nature of the Chickahominy Power facility to the regional power grid, the operational continuance of a reliable water system is crucial to the reliable delivery of electric energy produced at the facility.

Recognizing that the location in Charles City County will necessitate efficient use of groundwater; Chickahominy Power has specifically designed the power generation facility to use the least amount of groundwater possible which represents the principal foundation of its Water Conservation and Management Plan.

### **1.2 Groundwater Management Area in Eastern Virginia**

Under the Ground Water Management Act of 1992, Virginia manages groundwater through a program that regulates the withdrawals of groundwater in certain areas called Groundwater Management Areas (GWMA). Currently, there are two Groundwater Management Areas in the state. The Eastern Virginia Groundwater Management Area (EVGWMA) comprises all areas east of Interstate 95. The Eastern Shore Groundwater Management Area includes Accomack and Northampton counties. Any person or entity located within a declared GWMA must obtain a permit to withdraw 300,000 gallons or more of groundwater in any one month.

Chickahominy Power will be located in Charles City County, which is included in the EVGWMA.

### **1.3 Water Conservation and Management Plan**

Applicants seeking a new withdrawal in the groundwater management area are required to develop a Water Conservation and Management Plan (WCMP) and submit it to DEQ. Plans will be reviewed to assure that required elements are addressed; the approved plan becomes an enforceable part of the approved groundwater withdrawal permit.

The Code of Virginia (Title 9. Environment Agency 25. State Water Control Board. Chapter 610. Groundwater Withdrawal Regulations) requires the following elements be addressed in plans for commercial and industrial users:

*For nonpublic water supply applicants - commercial and industrial users:*

- a. Where applicable, the plan should require use of water-saving equipment and processes for all water users including technological, procedural, or programmatic improvements to the facilities and processes to decrease the amount of water withdrawn or to decrease water demand. The goal of these requirements is to assure the most efficient use of groundwater. Information on the water-saving alternatives examined and the water savings associated with the alternatives shall be provided. Also, where appropriate, the use of water-saving fixtures in new and renovated plumbing as provided in the Uniform Statewide Building Code (13VAC5-63) shall be identified in the plan;*
- b. A water loss reduction program, which defines the applicant's leak detection and repair program. The water loss reduction program shall include requirements for an audit of the total amount of groundwater used in the distribution system and operational processes during the first two years of the permit cycle. Implementation of a leak detection and repair program shall be required within one year of the date the permit is issued. The program shall include a schedule for inspection of equipment and piping for leaks;*
- c. A water use education program that contains requirements for the education of water users and training of employees controlling water consuming processes to assure that water conservation principles are well known by the users of the resource. The program shall include a schedule for information distribution and the type of materials used;*
- d. An evaluation of water reuse options and assurances that water shall be reused in all instances where reuse is practicable. Potential for expansion of the existing reuse practices or adoption of additional reuse practices shall also be included; and*
- e. Requirements for complying with mandatory water use reductions during water shortage emergencies declared by the local governing body or water authority in accordance with §§ 15.2-923 and 15.2-924 of the Code of Virginia. This shall include, where appropriate, ordinances prohibiting the waste of water generally and requirements providing for mandatory water use restrictions in accordance with drought response and contingency ordinances implemented to comply with 9VAC25-780-120 during water shortage emergencies. The water conservation and management plan shall also contain requirements for mandatory water use restrictions during water shortage emergencies that restricts or prohibits all nonessential uses such as lawn watering, car washing, and similar nonessential industrial and commercial uses for the duration of the water shortage emergency.*

Each of the items that must be in the Plan is discussed in the following pages and describes Chickahominy Power's strategies for addressing conservation and demand management goals.

-- End of Section --

## **2.0 CONSERVATION AND DEMAND MANAGEMENT**

### **2.1 Water-Saving Equipment and Processes**

Chickahominy Power has been specifically designed to minimize the overall demand for water, most notably through the use of air-cooled condenser technology in lieu of a more conventional water-cooling technology to condense and reuse the high pressure steam that powers the steam turbine generators, and through the extensive use of blowdown recapture and waste water recovery systems. Process water demand, in general terms, consists of service water to operate inlet air evaporative coolers for the gas turbine systems (significantly improving plant efficiency on hot days), to produce demineralized water used as boiler make up water, and other uses including water for maintenance and cleanup. Water will also be stored on site for fire protection if needed.

The proposed rate of average water use (57.1 gpm) and the proposed plant power output (1600 megawatts) yield a unit output of 0.002 gallons/kilowatthour. As a contrast, in a U.S. Energy Information Administration publication titled “Today in Energy – Water withdrawals by U.S. power plants have been declining” (copy attached), the average national usage rate in 2017 was 13.0 gallons/kilowatthour. Water withdrawal intensity in Virginia was also reported to be in the range of 20 to 30 gallons/kilowatthour. The amount of water proposed for use for the Chickahominy Power facility is drastically lower than the national average and the Virginia usage range.

The water system used for the process of generating electricity, will also include providing water to approximately 45 employees on site – potable water will be used for domestic uses - restrooms, handwashing and minimal kitchen facilities and irrigation purposes

### **2.2 Water Loss Reduction Program**

The Chickahominy Power facility will be all new construction. The design of the facility incorporates not only process equipment that reduces water demands (as described above) but also a system of water for potable water uses. Faucets and fixtures that will be installed for potable water usage will be up-to-date water efficient fixtures that are in compliance with the Uniform Statewide Building Code.

Chickahominy Power’s water loss reduction program will focus on loss of water by routine checks for system leaks, frequent water use monitoring and control, immediately attending to system leaks (corrective maintenance), and maintaining a preventive maintenance program. The program will be implemented immediately upon start-up of the power facility, and Chickahominy Power will provide DEQ documentation that the program has been initiated within the first year of the permit.

The water loss reduction program is centered on the following:

#### Industrial Process

- All water use will be monitored on a daily basis (including groundwater withdrawals) to identify any values that are outside of normal usage and will necessitate investigation of piping and process equipment where there may be a leak;
- Any equipment or piping where water loss is occurring will be repaired or replaced as expediently as possible; and

#### Domestic Service

- Weekly reading and recording of domestic water use (i.e., non-industrial) will allow the employees

at the site to identify any values that are outside of normal usage and will necessitate investigation of piping and process equipment where there may be a leak;

- Any equipment or piping where water loss is occurring will be repaired or replaced as expediently as possible; and
- Any leaks within the domestic water use system – for example leaking faucet or running toilet – will be repaired immediately.

### **Water Use Monitoring**

Each production well meter will be read on a daily basis, as will each system/process meter throughout the facility. Once baseline water usage trends have been established, the facility will compare each week's usage to normal/average ranges and will take appropriate action to look for leaks if the usage data indicates unaccounted for water that could indicate a leak in the system. In addition to this daily meter reading and weekly analysis, the facility will conduct an annual water audit to evaluate and look for signs of anomalous usage that could indicate water losses.

### **Leak Detection Program**

The facility's leak detection program involves facility/maintenance staff, system operators, and security personnel. System operators will be employed by a contractor that specializes in the overall operation and maintenance (O&M) of the facility. System operators will inspect all above-ground piping, fittings, and system components including those inside the plant on a daily basis. Security personnel will be trained to immediately report leaks observed during their routine patrols of the facility. Operators and security staff will report any observed leaks to the plant manager or maintenance manager immediately so that a prompt repair can be made.

Suspected leaks in underground piping discovered via water use monitoring as detailed above but which do not present visual evidence of a leak such as saturated soil or standing water on the surface will be investigated through the following steps:

1. Visual inspection by walking the entire length of each section of underground system piping to look for surface evidence of a leak.
2. If no surface evidence is found, then the facility will check and calibrate or replace the flowmeter or meters indicating a possible leak.
3. If the meter or meters are determined to be accurate and the leak has not manifested at the surface, the facility will continue investigating by excavation. Excavation would begin at the likeliest leak points such as joints or bends in the subsurface piping.

### **Preventive and Corrective Maintenance**

Prior to activating the water system for the proposed power facility, all piping and system components will be pressure-tested in accordance with AWWA Standards. During this pressure testing procedure, operators will walk the entire system to check for leaks. Any system piping located outside the plant buildings or a heated area will be insulated and equipped with heat tape or other measures to prevent freezing. Near the end of fall/beginning of winter each year, operators will inspect all piping located outside plant buildings to ensure that insulation and freeze-prevention systems are intact and working properly. Although Chickahominy Power does not anticipate that the plant or portions of the plant will be deactivated for extended periods of time following initial startup, should this occur, the operators will blow out any outside piping and other system components to prevent water from freezing and breaking. In the unlikely event of a plant shutdown and restart, operators will conduct a start-up leak inspection by walking the entire length of the water system.

Corrective maintenance, or repairs of leaks, will occur as soon as possible. Normally, leaks will be repaired within 24 hours depending on the type, severity, and location of the leak. Readily-accessible leaks detected above-ground can usually be repaired within 24 hours if replacement parts are available. Subsurface leaks that involve excavation will normally require more time to complete, possibly 48 to 72 hours. Major leaks that would severely impact the operation of the power plant are a high priority and will be repaired as quickly as possible to return the facility to

operation. To the extent possible, the facility will deactivate or isolate sections of the water system to prevent water loss until a confirmed leak of a minor nature is repaired.

### **Water Use Audit**

The Chickahominy Power facility will conduct an audit of the total amount of groundwater used during the first two calendar years of the permit cycle. The audit will consist of the following:

- Review of annual and monthly groundwater usage data and comparison of this data to water demand estimates provided in the GWWP application and to GWWP monthly and annual limits;
- Review of leak detection and repair records; and
- Submittal of an Audit Report to DEQ.

## **2.3 Water Use Education Program**

Chickahominy Power will institute a policy that calls for the following:

- All employees will be made aware of the EVGWMA and its implications at the operation of the Charles City County facility.
- All employees will be made aware of this Water Conservation and Management Plan. Electronic copies will be provided to each employee, and a hard copy will be available for review at all times in the plant manager's office.
- At the start of employment at the facility, every employee will be provided training regarding the importance of conserving water, the details of the company's water withdrawal permit, and the need to efficiently use water.
- On at least an annual basis, this Water Conservation and Demand Management Plan will be reviewed with staff and management.
- Management will update the Plan as needed, and provide a copy to DEQ.

## **2.4 Water Reuse Options**

Water reuse processes have been included in the overall power generation process to the maximum extent possible. As presented in the revised Water Balance in the GWWP application, process water will be reused to the greatest extent possible such that there is very little liquid discharge related to the power generation process itself. Features incorporated into the design include:

- Mixed bed ion exchange demineralization technology – eliminates waste stream associated with alternative reverse osmosis technology and associated water consumption
- Blowdown recovery systems for evaporative cooler and boiler – blowdowns are routed to a recovery system which removes excess chemicals and dissolved solids as necessary for reuse in the process
- Blowdown flash steam recovery – high pressure blowdown will be routed to a flash tank where the flash steam will be recovered and reused in the process to produce power, further reducing water consumption

The plant will include metering to monitor water supply and consumption. The plant control system will record historic data for auditing. As indicated above, the O&M contractor will be responsible for maintaining all equipment with routine inspections to ensure the processes are operating as designed and to check for leaks.



Future water reuse options will be employed as appropriate. Water reuse options will be formally evaluated by the facility at least every five (5) years, and the results of this evaluation will be discussed in the Water Conservation and Management Plan Effectiveness Reports to be submitted to DEQ by the end of years five (5) and ten (10) of the permit.

## **2.5 Requirements for Mandatory Water Use Reductions During Water Shortages**

As noted in earlier section of this Plan, the facility will have contractual agreements to provide electricity to the electrical grid and those agreements must be honored even during periods of drought or other local or regional periods of water shortages.

At any time that Charles City County or the Governor of Virginia declare a drought watch, warning or emergency<sup>1</sup>, Chickahominy Power will observe any requirements to reduce non-essential use of water. “Non-essential use of water” means usage related to the domestic uses at the facility. In addition to these mandatory water use reductions, the facility will require the following voluntary water use restrictions in general as well as during water shortage emergencies:

- Restrict or terminate the use of area irrigation sprinklers
- Restrict or terminate the washing of site grounds
- Restrict or terminate the washing of site vehicles
- Minimize or eliminate discretionary use of potable water

### **WCMP Effectiveness Reporting**

By the end of years five (5) and ten (10) of the GWWP term, Chickahominy Power will develop a report on the effectiveness of this WCMP in minimizing water use. This will include revisions to those elements of the WCMP that can be improved and addition of other elements found to be effective based on operations to date. These reports shall include:

- Any new water-saving equipment installed or water-saving processes adopted
- WCMP actions taken to reduce the volume of water needed to supply the system
- Planned short or long-term efforts and actions to be added to the WCMP to improve the efficiency of water use in the system and for reducing the loss of water
- Results of additional water audits completed
- Evaluation of the leak detection and repair program
- Description of educational activities completed
- Identification of any water reuse opportunities identified

*-- End of Section --*

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<sup>1</sup> “Drought Watch” is intended to increase public awareness of climatic conditions that are likely to precede the occurrence of a significant drought event.

“Drought Warning” would necessitate voluntary actions to reduce water usage – in particular, any non-essential use of water.

“Drought Emergency” would generally restrict water usage to only those purposes that are absolutely essential to life, health and safety. All non-essential uses will be eliminated.

## **MITIGATION PLAN**

**DEQ GROUNDWATER WITHDRAWAL PERMIT NO.**      GW0078700

**OWNER NAME:**              Chickahominy Power LLC

**FACILITY NAME:**          Chickahominy Power

**LOCATION:**                  Chambers Road, Charles City County, Virginia

### **INTRODUCTION**

On November 14, 2018, Chickahominy Power LLC submitted a Groundwater Withdrawal Permit Application to the Virginia Department of Environmental Quality (DEQ) to withdraw groundwater. Groundwater withdrawals associated with this permit will be utilized at the proposed 1,600-megawatt natural gas-fired combined cycle electric generating facility. The facility will generate enough electricity to supply approximately one million residential customers.

The purpose of this Mitigation Plan is to provide existing groundwater users a method to resolve claims that may arise due to the impact of the withdrawal from the Chickahominy Power well field. Predicted drawdown of water levels due to the withdrawal(s) from the Potomac aquifer are shown in the attached maps.

Modeled impacts, as shown on the attached maps, extend beyond the boundary of the Chickahominy Power facility. Due to these findings, Chickahominy Power LLC recognizes that there will be a rebuttable presumption that water level declines that cause adverse impacts to existing groundwater users within the area of impact are due to this withdrawal. Claims may be made by groundwater users outside this area; however, there is a rebuttable presumption that Chickahominy Power LLC has not caused the adverse impact. Chickahominy Power LLC proposes this plan to mitigate impacts to existing users and excludes impacts to wells constructed after the effective date of this permit.

### **CLAIMANT REQUIREMENTS**

To initiate a claim, the claimant must provide written notification of the claim to the following address:

Contact Name	Irfan K. Ali
Title	Managing Member
Permittee Name	Chickahominy Power LLC
Address	13800 Coppermine Road, Suite 115 Herndon, VA 20171

The claim must include the following information:

- (a) a deed or other available evidence that the claimant is the owner of the well and the well was constructed and operated prior to the effective date of the permit;
- (b) all available information related to well construction, water levels, historic yield, water quality, and the exact location of the well sufficient to allow Chickahominy Power LLC to locate the well on the claimant's property;
- (c) the reasons the claimant believes that the Chickahominy Power withdrawal has caused an adverse impact on the claimants well(s).

### **CLAIM RESOLUTION**

Chickahominy Power LLC will review any claim within **five (5) business days**. If Chickahominy Power LLC determines that no rebuttal will be made and accepts the claim as valid, Chickahominy Power LLC will so notify the claimant and will implement mitigation within **thirty (30) business days**. If the claim is not accepted as valid, Chickahominy Power LLC will notify the claimant that (a) the claim is denied **or** (b) that additional documentation from the claimant is required in order to evaluate the claim. Within **fifteen (15) business days** of receiving additional documentation from the claimant, Chickahominy Power LLC will notify the claimant (a) that Chickahominy Power LLC agrees to mitigate adverse impacts or (b) the claim is denied. If the claim is denied, the claimant will be notified that the claimant may request the claim be evaluated by a three (3) member committee. This committee will consist of one (1) representative selected by Chickahominy Power LLC, one (1) representative selected by the claimant, and one (1) representative mutually agreed upon by the claimant and Chickahominy Power LLC.

Any claimant requesting that a claim be evaluated by the committee should provide the name and address of their representative to Chickahominy Power LLC. Within **five (5) business days** of receipt of such notification, Chickahominy Power LLC will notify the claimant and claimant's representative of the identity of Chickahominy Power LLC representative and instruct the representatives to select a third representative within **ten (10) business days**. Representatives should be a professional engineer or hydrogeologist with experience in the field of groundwater hydrology. Chickahominy Power LLC agrees to reimburse the members of the committee for reasonable time spent, at a rate prevailing in the area for experts in the above listed fields, and for direct costs incurred in administering the plan. The claimant may, at his or her option, choose to provide the reimbursement for the member of the committee selected by the claimant and up to half of the reimbursement for the mutual representative.

Within **ten (10) business days** of selection of the third representative, the committee will establish a **reasonable deadline** for submission of all documentation needed to evaluate the claim. Both the claimant and Chickahominy Power LLC will abide by this deadline.

Within **fifteen (15) business days** of receipt of documentation, the committee will evaluate the claim and reach a decision by majority vote. The committee will notify the claimant regarding its decision to (a) deny or (b) approve the claim. If the claim is approved, Chickahominy Power LLC will mitigate the adverse impacts within **thirty (30) business days** of making the decision or as soon as practical. If the

claim is denied by the committee, Chickahominy Power LLC may seek reimbursement from the claimant for the claimant's committee representative and one half of the 3<sup>rd</sup> representative on the committee.

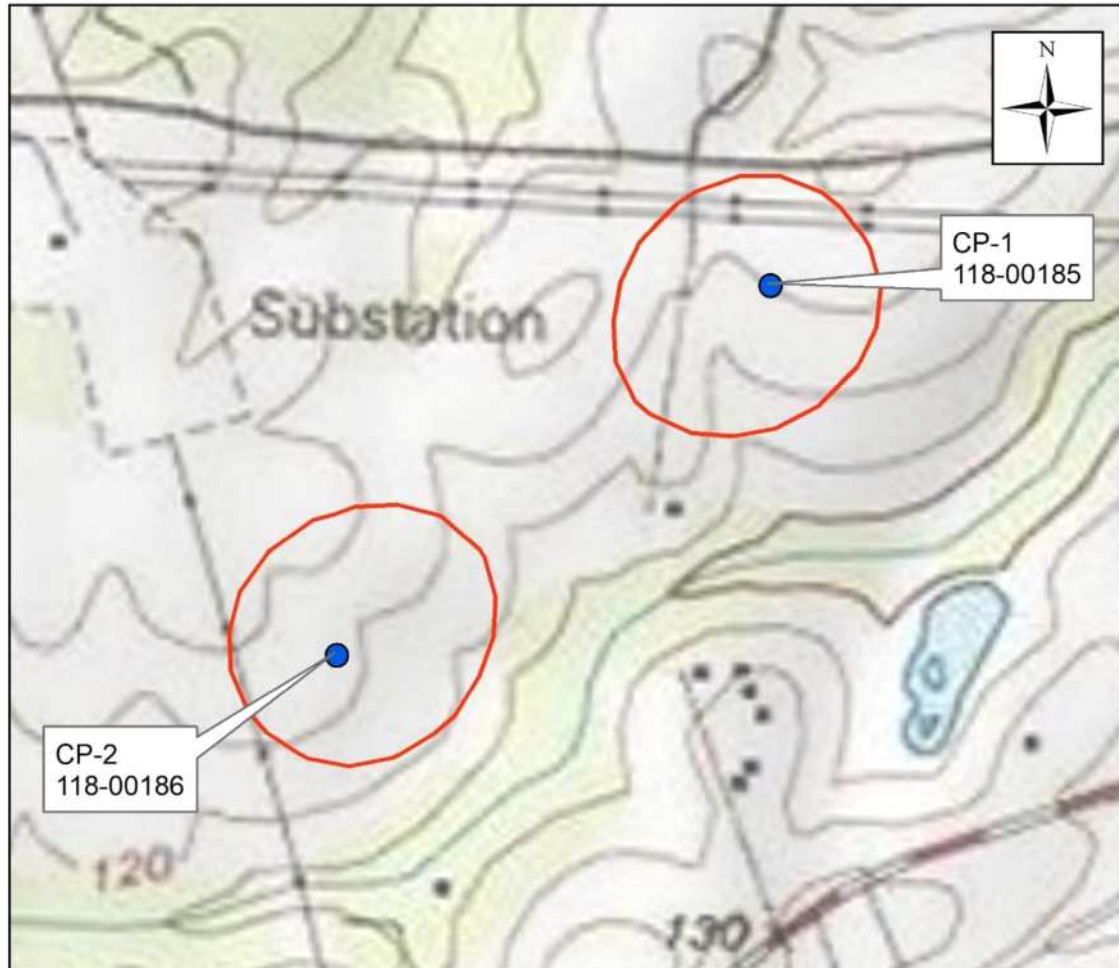
If a claimant within the indicated area of impact indicates that they are out of water, Chickahominy Power LLC will accept the responsibility of providing water for human consumptive needs within **seventy-two (72) hours** and to cover the claim review period. Chickahominy Power LLC reserves the right to recover the cost of such emergency supply if the claim is denied by Chickahominy Power LLC or found to be fraudulent or frivolous. If Chickahominy Power LLC denies a claim and the claimant elects to proceed with the three (3) member committee, Chickahominy Power LLC will continue the emergency water supply at the claimants request during the committee's deliberations, but reserves the right to recover the total costs of emergency water supply in the case that the committee upholds the denial of the claim. Similarly, Chickahominy Power LLC reserves the right to recover costs associated with the claim process if a claim is found to be fraudulent or frivolous.

If it is determined by the committee or shown to the committee's satisfaction that a well operating under a mitigation plan similar to Chickahominy Power LLC's Plan other than those owned and operated by Chickahominy Power LLC has contributed to the claimed adverse impact, Chickahominy Power LLC's share of the costs associated with mitigation will be allocated in proportion to its share of the impact. Such a determination shall be made by the committee after notification of the third party well owner, giving the third party well owner opportunity to participate in the proceedings of the committee.

#### **PLAN ADMINISTRATION**

Nothing in the Plan shall be construed to prevent the Department of Environmental Quality Staff from providing information needed for resolution of claims by the committee.

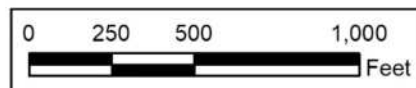
## Chickahominy Power Plant Area of Impact - Potomac Aquifer



● Chickahominy Power Plant Wells

○ Area of Impact

Simulated drawdown at or exceeding one foot in the Potomac aquifer resulting from a 2-dimensional Hantush and Jacob (1955) simulation of 82,191 average gallons per day for 7 years from the Potomac aquifer. The maximum radius of one-foot drawdown (Area of Impact) occurs approximately 540 feet from each production well.



Technical Evaluation performed  
by Aquaveo, LLC for the Virginia  
DEQ, Office of Water Supply  
October 29, 2019

